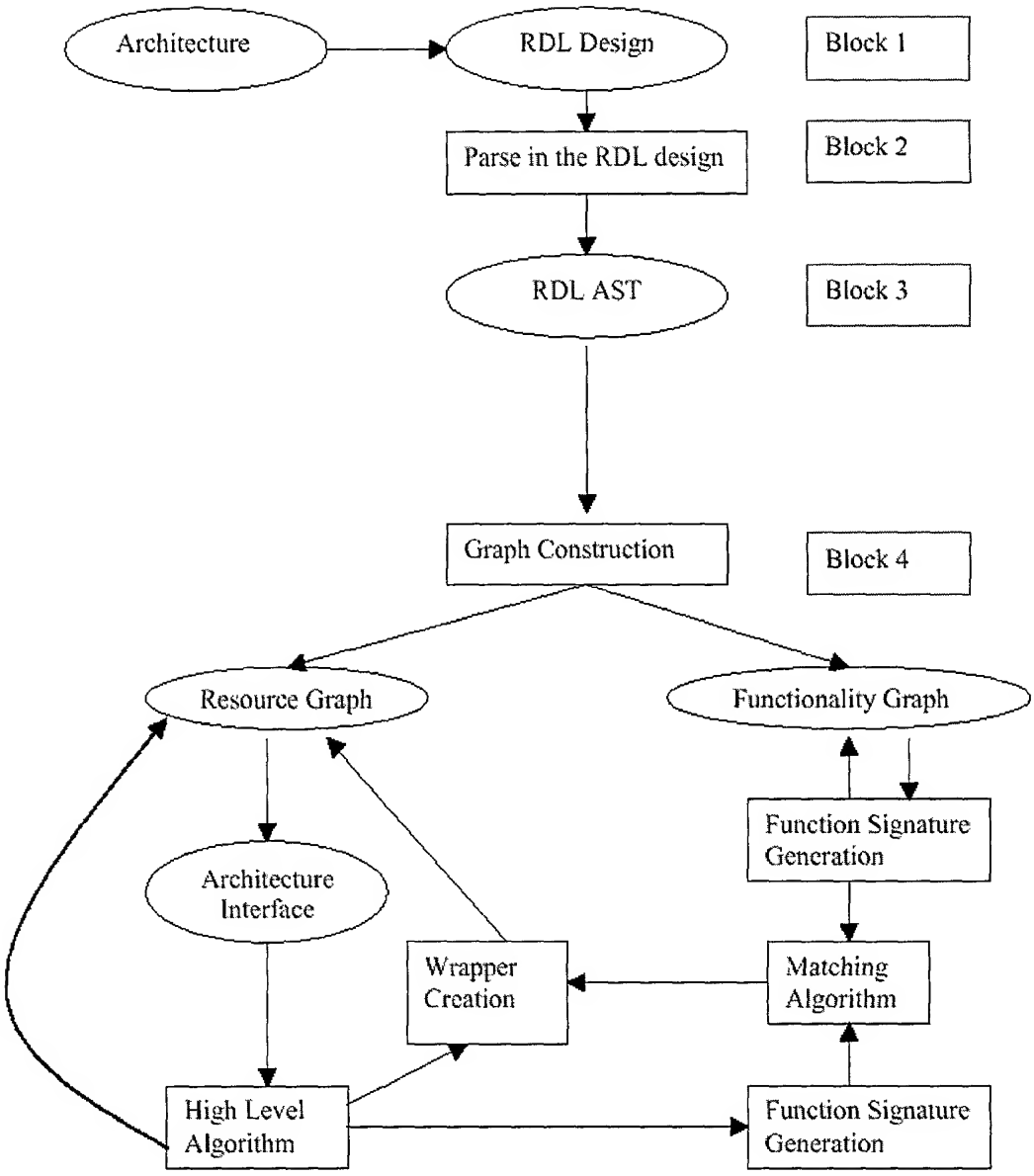

Architecture
RDL Design
Block 1
Parse in the RDL design
Block 2
RDL AST
Block 3
Graph Construction
Block 4
Resource Graph
Functionality Graph
Function Signature Generation
Architecture Interface
Wrapper Creation
Matching Algorithm
High Level Algorithm
Function Signature Generation

Figure 1

5

Figure 2

```
////////////////////////////////////////
//  Declaration of a pipelined 16 x 16 //
//  unsigned multiplier                //
////////////////////////////////////////

RESOURCEDEF MULT16x16_FULLPIPE_UNSIGNED
{
  ////////////////////////////////////
  //  A Multiplier                  //
  ////////////////////////////////////
  FUNCTIONALITY MULT;

  ////////////////////////////////////
  // The intantiation code for a    //
  // specific multiplier            //
  ////////////////////////////////////
  ATTRIBUTE INSTANTIATION
  {
   ////////////////////////////////////////////
   // component_name is the specific soft IP //
   // instance that needs to be accessed     //
   ////////////////////////////////////////////
      attribute +
        "input wrap unsigned fixed[16,0] " + component_name + "_A;\n" +
        "input wrap unsigned fixed[16,0] " + component_name + "_B;\n" +
        "output wrap unsigned fixed[32,0] " + component_name + "_R;\n";

      attribute +
```

```
        "instantiate mult16x16_fullpipe_unsigned : " + component_name +
          "(" +       "A = " + component_name + "_A," +
                      "B = " + component_name + "_B," +
                      "clk = " + clock_name + "," +
                      "clr = " + reset_name + "," +
                     "R = " + component_name + "_R" +
                  ");";
 }

 ////////////////////////////////////////
 //   Whether the Soft IP core can     //
 //   perform the multiplication       //
 ////////////////////////////////////////

 ATTRIBUTE CAN_DO
 {
   <MULT>
     {
       if(in1->bitwidth() < 17 && in2->bitwidth() < 17 &&
         in1->is_unsigned() == true && in2->is_unsigned() == true)
        {
          attribute + "true";
        }
       else
        {
          attribute + "false";
        }
     }
 }
```

```
////////////////////////////////////////
// The Pipeline latency. I.e. the     //
// number of clock cycles after       //
// which new data can be fed to the   //
// pipelined multiplier               //
////////////////////////////////////////

 ATTRIBUTE PIPE_DELAY
 {
   <MULT>
     {
        attribute + "1";
     }
 }

////////////////////////////////////////
// Is this a Combinatorial multiplier //
// or a Sequential multiplier. This   //
// decides if this multiplier can be  //
// chained or not                     //
////////////////////////////////////////

 ATTRIBUTE COMBINATIONAL
 {
   <MULT>
     {
        attribute + "false";
     }
```

```
}

////////////////////////////////////
// The multiplier latency. I.e. the //
// number of clock cycles after     //
// which processing is over         //
////////////////////////////////////

ATTRIBUTE NUM_STATES
{
  <MULT>
    {
        attribute + "6";
    }
}

////////////////////////////////////
// Interface access mechanism wherein //
// we have fixed latency of 6 clock   //
// cycles with a throughput of 1      //
////////////////////////////////////

ATTRIBUTE INTERFACE
{
    <MULT>
    {
      attribute + "state1: {";
      attribute + component_name + "_A = " + in1->name() + " ; \n";
      attribute + component_name + "_B = " + in2->name() + " ; \n";
```

```
        attribute + "goto state2 ;\n";
        attribute + "}";
        attribute + "state2: {";
        attribute + "goto state3 ;\n";
        attribute + "}";
        attribute + "state3: {";
        attribute + "goto state4 ;\n";
        attribute + "}";
        attribute + "state4: {";
        attribute + "goto state5 ;\n";
        attribute + "}";
        attribute + "state5: {";
        attribute + "goto state6 ;\n";
        attribute + "}";
        attribute + "state6: {";
        attribute + out1->name() + " = " + component_name + "_R ; \n";
        attribute + "goto NEXTSTATE ;\n";
        attribute + "}";
      }
  }
}
```

Figure 3

```
//////////////////////////////////////
// Declare a new functionality      //
// which accumulates data           //
//////////////////////////////////////

FUNCTIONALITYDEF ACCUMULATE {

INPUT a,over;
OUTPUT q;

ADD adder;

DCONNECT(a,adder->in1);
DCONNECT(adder->out1,adder->in2);
}

//////////////////////////////////////////
//  Declaration of a accumulator with a //
//  variable latency                ///
//////////////////////////////////////////

RESOURCEDEF ACCUMULATOR_VAR_LATENCY
{
  ////////////////////////////////////
  //  An Accumulator                //
  ////////////////////////////////////
  FUNCTIONALITY ACCUMULATE;
```

```
//////////////////////////////////////
// The adder latency is variable. In //
// that case, this marks the number  //
// of states in the interface code   //
//////////////////////////////////////

ATTRIBUTE NUM_STATES
{
  attribute + "2";
}

//////////////////////////////////////
// Interface access mechanism wherein //
// we have variable latency          //
//////////////////////////////////////
ATTRIBUTE INTERFACE
{
      attribute + "state1: {";
      attribute + "if(" + over->name() + " = '1'){\n" +
                  "goto NEXTSTATE;}\n";
         attribute + "else { " +
                  "goto state2;}\n";
      attribute + "}";
         attribute + "state2: {";
      attribute + q->name() + "=" + q->name() + "+" + a->name() + ";";
         attribute + "}\n";
 }
}
```

Figure 4

```
//////////////////////////////////////
// Declare a new functionality      //
// which accumulates N data         //
//////////////////////////////////////

FUNCTIONALITYDEF ACCUMULATE {

INPUT a,N;
OUTPUT q;

ADD adder;

DCONNECT(a,adder->in1);
DCONNECT(adder->out1,adder->in2);
}

//////////////////////////////////////////
//  Declaration of a accumulator with a //
//  variable latency                ///
//////////////////////////////////////////

RESOURCEDEF ACCUMULATOR_VAR_LATENCY
{
  ////////////////////////////////////
  //  An Accumulator                //
  ////////////////////////////////////
  FUNCTIONALITY ACCUMULATE;
```

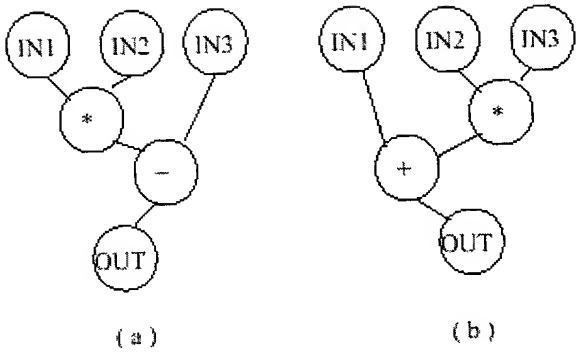
```
//////////////////////////////////////
// The adder latency is variable and //
// is equal to N where N is an input //
// port of the ACCUMULATE function   //
//////////////////////////////////////

ATTRIBUTE NUM_STATES
{
  attribute + "1";
}

//////////////////////////////////////
// Interface access mechanism wherein //
// we have variable latency          //
//////////////////////////////////////

ATTRIBUTE INTERFACE
{
      attribute + "state1: {";
      attribute + "for(i = 0;i < " +
                    N->name() + ";i = i + 1){";
        attribute + q->name() + "=" + q->name() +
                  " + " + a->name() + ";}\n";
        attribute + "goto NEXTSTATE;\n";
        attribute + "}\n";
}
}
```

a = x * y − z

(i)

a = z − x * y

(ii)



(a) (b)

Figure 5